Small Business Innovation Research/Small Business Tech Transfer

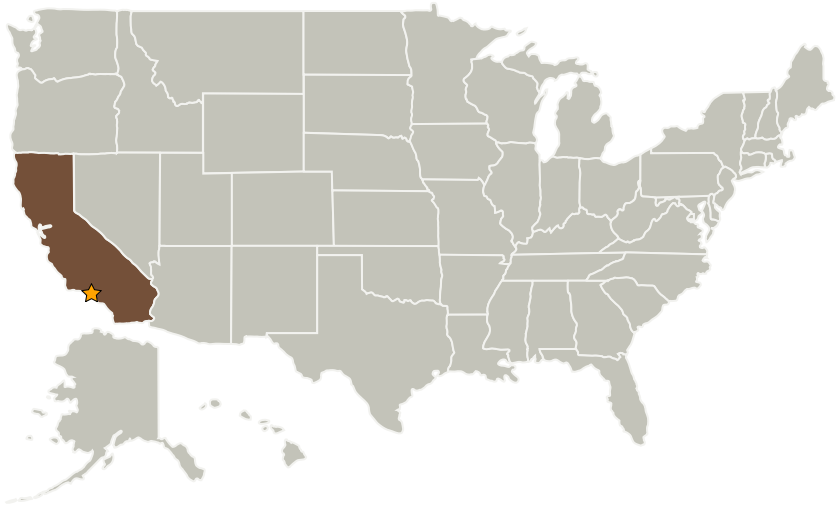
Fault Detection, Identification, Reconstruction, and Fault-Tolerant Estimation for Distributed Spacecraft, Phase II

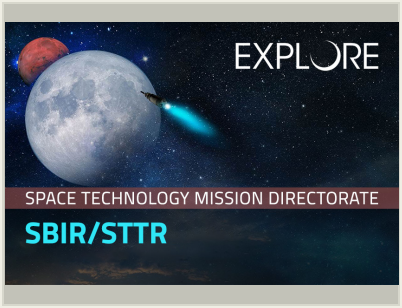
Completed Technology Project (2006 - 2008)

Project Introduction

Formation flying enables new capabilities in distributed sensing, surveillance in Earth orbit and for interferometer imaging in deep space as envisioned by the Terrestrial Plant Finder-Interferometer (TPF-I) mission. Specifically, formation flying spacecraft refer to a set of spatially distributed spacecraft interacting and cooperating with one another. Our objective in Phase II is to develop and implement highly reliable fault detection, identification, and reconstruction algorithms that take into account the high analytic redundancy of the spacecraft and the distributed spacecraft system. In the Phase I our analytic redundancy management methodology was developed and demonstrated on a small distributed and collaborative set of simulated spacecraft. These results are to be generalized and applied to realistic spacecraft systems in Phase II. Faults in spacecraft sensors and actuators of a cluster of spacecraft are to be detected, identified, and reconstructed using abstractions from high-fidelity models such as found in FAST (Formation Algorithms and Simulation Testbed). From these analytical redundancy algorithms a fault-tolerant state estimator is constructed which is not corrupted by system faults. These techniques will be implemented and tested in FAST. These algorithms will be transferred to the Formation Control Testbed (FCT) robots and tested and verified in FCT.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
SySense, Inc.	Supporting Organization	Industry	El Segundo, California

Primary U.S. Work Locations
California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.5 GN&C Systems Engineering Technologies
    - TX17.5.2 GN&C Fault Management / Fault Tolerance / Autonomy